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Discovering the Neural Circuits Behind Spatial Recognition in C. elegans

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Animals acquire proper behaviors to survive, to mate, and to reproduce. Sensation of the surroundings tunes animal behaviors for optimal outcomes. We are interested in how external information is integrated by the neuronal network to promote animal decision and behavior.

*Caenorhabditis elegans*, a round worm with only 302 neurons, is capable to modulate behaviors in response to stimuli such as chemicals, light and mechanical forces. Here, we discovered that *C. elegans* is able to differentiate various environments based on spatial information, e.g. worms are highly enriched in areas with dense objects. This enrichment is achieved by reducing forward movements when entering the preferred area, as well as by enhancing the returning behaviors after leaving the area. We found that mechanosensation defective mutants have significant reduction in enrichment. In particular, removal of a stretch receptor (TRP-4) completely diminished the enrichment. This data suggests that body stretch is the driving force for worms to choose where to stay. Finally, the neuronal mechanism for worms to decode spatial information may be actively evolving, as wild isolates (the Hawaii strain vs. the Bristol N2 strain) make different decisions when facing spatial choices. Our current hypothesis is that the diversified behavior between N2 and Hawaii strains arises from a polymorphism in the stretch receptor TRP-4.